

DIVISION 300 - BASES

The sections in the 300 series include the specification requirements for bases, shoulders, and other work closely related to the construction of the pavement foundation and shoulders.

The term "course" used in this series of sections shall be understood to mean a structural component of specified thickness. A course may consist of one or more layers.

Shoulder courses shown on the plans to be constructed separately from base courses shall be performed in accordance with the provisions and requirements of Section 320.

SECTION 304 - GRANULAR COURSES

304.01--Description. This work consists of furnishing granular materials and the construction of one or more courses of base, shoulders, or other required construction on a prepared foundation in reasonably close conformity with the lines, grades, and typical cross sections shown on the plans or established by the Engineer.

304.02--Materials.

304.02.1--General. Unless otherwise specified, materials used in this work shall conform to the requirements of Subsections 703.04 & 703.07. General conditions governing the use of materials shall be as set out in Section 106.

304.02.2--Sampling, Testing and Acceptance. A minimum of one random sample will be obtained from the roadway for each 1000 cubic yards or 1400 tons for determining acceptance of the material for gradation, liquid limit and plasticity index. When borderline or failing results are obtained the Engineer may increase the sampling frequency.

When a roadway sample fails to meet the requirements of the specifications additional samples will be taken along the roadway for determining the limits of the inferior material. Such inferior material shall be corrected or removed and replaced at no additional costs to the State.

304.03--Construction Requirements.

304.03.1--Equipment. When measurement for payment is to be made by the ton, the Contractor shall furnish approved platform scales capable of weighing the entire loaded vehicle. Scales and their use shall be in accordance with the requirements set out in Subsection 401.03.2.1.11, except they shall be installed at

an approved location on or near the project.

Rollers shall be of sufficient number, type, size, and weight to accomplish the required compaction.

Watering equipment shall have pressurized spray bars with suitable nozzle openings.

304.03.2--Preparation of Grade. The foundation on which granular material is to be placed shall be prepared as set out in Section 321. A section of prepared roadbed of sufficient length to allow time for inspection, test, necessary corrections, and approval shall be maintained at all times ahead of placing material.

304.03.3--Placing of Materials. The Contractor shall be responsible for furnishing a material that meets the requirements of the contract and in such quantity to produce the specified compacted thicknesses. All material placed in excess of the tolerances allowed in Section 321 shall be removed and placed at other approved locations, or removed and hauled off the project without compensation.

A course whose compacted thickness is designated to be more than eight inches shall be constructed in two or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed eight inches.

No granular materials shall be placed while frozen or placed on frozen materials.

When the Engineer determines that in-place material, including the top portion of the design soil, is wet to the degree that there is a possibility of rutting, deforming, or displacing the underlying material, the hauling operation shall be suspended.

The Contractor shall produce such material as is necessary to meet the specifications for gradation, liquid limit and plasticity index and shall make such corrections as are necessary or shall remove and replace, at no additional cost to the State, any deficient material placed in the work. In all cases of correcting deficiencies on the roadbed, the Contractor shall be fully responsible for any damage to the underlying course(s) and other work.

304.03.4--Blending. After the material has been initially shaped, the entire volume of material for the course or layer being placed shall be processed and blended by blading in such a manner and as many times as necessary to produce a course visually uniform in color and texture. Care shall be exercised during the blending process to prevent contamination with underlying material. The Contractor shall be fully responsible for damage to or contamination with underlying or other unlike material and shall make corrections as necessary at no

additional cost to the state.

When granular material is required to be placed adjacent to pavement in place, blending shall be performed to the satisfaction of the Engineer prior to placement of the material on shoulders.

304.03.5--Shaping, Compacting, and Finishing. Each course or layer of material shall be shaped to the required section, watered or aerated as necessary to provide the needed moisture content for compaction, and compacted. Throughout the compaction operation, the shape of the course or layer shall be maintained by blading and rolling so that the aggregates are uniformly distributed and firmly keyed.

Shaping and compaction shall be carried out in a manner that will prevent lamination and shall continue until the entire depth and width of the course or layer has reached the required density. Surface compaction and finishing shall be performed so as to produce a smooth, closely knit surface that is free from lamination, cracks, ridges or loose material. The finished surface shall conform, within allowable tolerances, to the required section and established lines and grades. Allowable tolerances are set out in Section 321.

Prior to subsequent construction or release of maintenance, all irregularities, depressions, soft spots, and other deficiencies found by the Engineer shall be corrected to meet the requirements of these specifications without additional compensation.

After compaction and finishing, if the mixture contains plus No. 4 aggregate and the course is to serve as a base for bituminous pavement, at least one complete coverage shall be made with a steel wheel roller. The resulting surface shall be sprinkled as necessary to maintain the required moisture content and shall be thoroughly compacted and sealed with a pneumatic roller.

In addition to the requirements for density and correction of deficiencies, the Contractor shall be responsible for constructing and maintaining a course which will remain firm and stable under construction equipment and other traffic which the course will be subjected to prior to release of maintenance.

Compaction by vibration shall not be performed on any course or layer placed over a previously chemically treated course(s).

Density tests will be performed in accordance with the methods as provided in Subsections 700.03 and 700.04.

Determination of acceptance of compaction of granular courses for required density will be performed on a lot to lot basis. Each lot will be each 2,500 linear feet per layer placed. At the discretion of the Engineer, a residual portion of a lot

completed during a day's operation may be considered as a separate lot or may be included in the previous or the subsequent lot, except that any day's operation of less than one full lot will be considered a lot.

The lot will be divided into five approximately equal sublots with one density test taken at random in each sublot. The individual tests and the average of the five tests shall equal or exceed the values as shown in the table below.

Granular Material	Lot	Individual
<u>Class</u>	<u>Average</u>	<u>Test</u>
7,8,9 or 10	97.0	93.0
5 or 6	99.0	95.0
3 or 4	100.0	96.0
1 or 2	102.0	98.0
Crushed Stone Courses	99.0	95.0

When pavement is not required, the required density for the top course will be as shown in the table below.

Granular Material	Lot	Individual
<u>Class</u>	<u>Average</u>	<u>Test</u>
10	94.0	90.0
7,8 or 9	95.0	91.0
5 or 6	96.0	92.0
3 or 4	97.0	93.0
1 or 2	98.0	94.0
Crushed Stone Courses	96.0	92.0

No density tests will be required for granular or crushed stone courses used for temporary work such as maintaining temporary ramps and driveways.

A finished course shall be continually maintained until a subsequent course is placed thereon or the work is released from maintenance.

304.04--Method of Measurement. Granular material and crushed stone courses will be measured by the cubic yard, average end area (AEA) or LVM, or by the ton, as indicated in the bid schedule of the contract.

When the method of measurement is by the ton, measurement will be made on the dry unit weight basis. The moisture determination for computing the dry unit weight will be made in accordance with the methods as provided in Subsections 700.03 and 700.04 at least once a day and as many additional times as the Engineer deems necessary.

When the method of measurement is by the cubic yard average end area method (AEA), all calculations of areas for payment shall be based on computations

made to the nearest hundredth of a square foot from the typical sections shown on the plans. The length will be measured along the surface of the course at the centerline of each roadway or ramp. The theoretical volume calculated for payment will be to the neat lines as shown on the plans. The accepted quantity for payment will be the itemized proposal quantity as adjusted for authorized changes. The itemized proposal quantity will be corrected if it is shown to be in error by more than 2.0 percent.

Water necessary for processing granular material will not be measured for separate payment.

304.05--Basis of Payment. Granular material and crushed stone courses will be paid for at the contract unit price per unit specified in the bid schedule of the contract, which shall be full compensation for completing the work.

Payment will be made under:

- 304-A: Granular Material, LVM, Class____, Group____ - per cubic yard
- 304-B: Granular Material, Class____, Group____ - per ton
- 304-C: Granular Material, AEA, Class____, Group____ - per cubic yard
- 304-D: Granular Material, Size - per ton
- 304-E: Granular Material, LVM, Size - per cubic yard
- 304-F: Size Crushed Stone Base - per ton
- 304-G: Size Crushed Stone Base, AEA - per cubic yard
- 304-H: Size Crushed Stone Base, LVM - per cubic yard

SECTION 305 - IN-GRADE MODIFICATION

305.01--Description. This work consists of modifying in place materials by incorporating other materials and constructing one or more courses in accordance with these specifications and in reasonably close conformity with the lines, grades, and typical cross sections shown on the plans or established by the Engineer.

305.02--Materials.

305.02.1--Materials to be Modified. The materials to be modified shall consist of material in place on the roadbed or material placed under this contract or a

combination thereof.

General conditions governing the use of materials shall be as set out in Section 106.

305.02.2--Stabilizer Aggregates. Stabilizer aggregates of the kind and size specified shall meet the requirements of Subsection 703.20.

305.03--Construction Requirements.

305.03.1--Equipment. The methods and equipment used in performing the work shall meet the requirements of Subsection 108.05. Equipment necessary for proper prosecution of the work shall be on the project and approved by the Engineer prior to commencing work.

Watering equipment shall have pressurized spray bars with suitable nozzle openings.

Mixing and scarifying equipment shall have positive depth controls.

Rollers shall be of sufficient number, type, size, and weight to accomplish the required compaction.

When measurement for payment for stabilizer aggregate is to be made by the ton, the Contractor shall furnish approved platform scales capable of weighing the entire loaded vehicle. Scales and their use shall be in accordance with the requirements set out in Subsection 401.03.2.1.11, except they shall be installed at an approved location on or near the project.

305.03.2--Processing.

305.03.2.1--Before Addition of Stabilizer Aggregate. The material to be modified shall be prepared in accordance with the requirements of Section 321. In addition, if the existing surface consists of bituminous surfacing, the surfacing shall be scarified, pulverized, and thoroughly mixed until all the material will pass a three-inch sieve. The material shall then be brought to the designated lines, grades, and cross sections and to the required density.

To insure proper prosecution of the work, sufficient roadbed shall be prepared in advance of spreading stabilizer aggregate.

305.03.2.2--After Addition of Stabilizer Aggregate. After the roadbed and in place material have been prepared as specified and approved, the designated quantity of aggregate to be added shall be uniformly spread.

The Contractor shall organize the work so that delay in spreading and

incorporation of aggregate will be only for the time necessary to haul the required quantity of stabilizer materials on a section of sufficient length to permit a single effective spreading, mixing, shaping, and compacting operation. Dumping of long lines of stabilizer aggregates on the roadbed and prolonged periods of hauling adjacent thereto will not be permitted. Unless wet soil conditions prevent satisfactory manipulation, aggregates shall be incorporated not later than the following day.

Preliminary scarifying shall be carefully controlled, and the undisturbed foundation beneath the loose material shall have a crown conforming as nearly as practicable to that of the finished course.

Mixing shall immediately follow the proper distribution of the aggregate and shall be performed with rotary or other agitating type mixers, supplemented by other equipment as necessary to pulverize the materials and thoroughly incorporate each into the other so that the resulting course will be uniform throughout. During mixing, sufficient water shall be added to bring the material to the proper moisture content.

Mixing shall be carefully controlled to provide an undisturbed underlying foundation at the designed grade and cross section, and shall be continued until a minimum of 95.0 percent of all materials, exclusive of individual rocks or stone, will pass a two-inch sieve.

The first section of each modified course constructed will serve as a test section. The length of the test section shall be determined by the capabilities of the equipment selected to perform the work but will be at least 1000 feet and not more than 1500 feet for the designated width. The Contractor and Engineer will evaluate the results of the test section in relation to contract requirements. In case the Engineer determines the work does not comply with contract requirements, the Contractor's procedure and augment or equipment shall be revise as necessary to provide work completed in accordance with the contract and shall correct all deficient work at no additional cost to the State.

The Contractor shall be fully responsible for damage to or contamination of the underlying material or shoulder material and shall make corrections as necessary at no additional cost to the State.

For the purpose of determining reasonable conformity with the designated width of a course, the width of a course shall not vary from the designated edge lines by more than plus or minus three inches.

A course whose compacted thickness is designated to be more than eight inches shall be constructed in two or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed eight inches.

No material shall be placed on or mixed with frozen material.

305.03.3--Shaping, Compacting and Finishing. Compaction shall start longitudinally at the outer edges of the course and proceed toward the center. The material shall be sprinkled or aerated as necessary during compaction to maintain the needed moisture content for compaction.

Shaping and compacting shall be carried out in a manner that will prevent lamination and shall continue until the entire depth and width of the course has reached the required density. Throughout the entire compaction operation, the shape of the course shall be maintained by blading and rolling. Surface compaction and finishing shall be performed so as to produce a smooth, closely knit surface, free from lamination, cracks, ridges, or loose material, and conforming to the required section and established lines and grades.

Prior to subsequent construction or release of maintenance, all irregularities, depressions, soft spots, and other deficiencies shall be corrected to meet the requirements of these specifications without additional compensation.

Density tests will be performed in accordance with the methods as provided in Subsection 700.03 and 700.04.

Determination of acceptance of compaction of in-grade modification for required density will be performed on a lot to lot basis. Each lot will be 2,500 linear feet per layer placed. At the discretion of the Engineer, a residual portion of a lot completed during a day's operation may be considered as a separate lot or may be included in the previous or the subsequent lot, except that any day's operation of less than one full lot will be considered a lot.

The lot will be divided into five approximately equal sublots with one density test taken at random in each subplot. The average of the five density tests shall equal or exceed 93.0 percent with no single density test below 89.0 percent.

In addition to the requirements for density and correction of deficiencies, the Contractor shall be fully responsible for constructing and maintaining a course which will remain firm and stable under construction equipment and other traffic the course will be subjected to prior to release of maintenance.

The finished surface of a course shall conform to the requirements shown on the plans within the tolerances allowable under Section 321 and shall be maintained until covered by a subsequent course or the work is released from maintenance.

305.04--Method of Measurement. Processing for in-grade modification will be measured by the square yard, station, or mile, as designated.

Stabilizer aggregates of the type or size specified will be measured by the cubic

yard (LVM) or by the ton, as indicated in the bid schedule of the contract. No measurement for payment for water will be made.

When the method of measurement is by the ton, measurement will be made on the dry unit weight basis at the point of weighing. The moisture determination for computing the dry unit weight will be made in accordance with the methods set out in Subsection 700.03 at least once a day, and as many additional times as the Engineer deems necessary.

305.05--Basis of Payment. Processing for in-grade modification will be paid for at the contract unit price per unit specified. Stabilizer aggregate will be paid for at the contract unit price per unit specified, which price shall be full compensation for completing the work.

Payment will be made under:

305-A: Processing for In-Grade Modification	- per square yard, station or mile
305-B: Size ___ Stabilizer Aggregate, Coarse	- per cubic yard or ton
305-C: Stabilizer Aggregate, Shell	- per cubic yard or ton
305-D: Stabilizer Aggregate, Medium	- per cubic yard or ton
305-E: Stabilizer Aggregate, Fine	- per cubic yard or ton

SECTION 306 - ASPHALT DRAINAGE COURSE

306.01--Description. This work shall consist of the construction of a bituminous drainage course composed of a mixture of crushed aggregate and asphalt cement properly laid upon a prepared surface, in accordance with these specifications and in conformity with the lines, grades, thickness, and typical sections shown on the plans.

306.02--Materials.

306.02.1--Aggregates. The aggregate shall be a size no. 57 crushed limestone, sandstone or granite conforming to the quality requirements of Subsections 703.01, 703.02 and 703.03.

306.02.2--Bituminous Material. The bituminous material used in the mixture shall be petroleum asphalt cement, Grade PG 67-22, unless otherwise designated, meeting the requirements of Section 702.

306.02.3--Hydrated Lime. Hydrated lime shall meet the requirements of Subsection 714.03.2 for lime used in soil stabilization.

306.02.4--Composition of Mixes. The mixture shall be have an asphalt cement content of 2.5 percent by weight of total dry aggregate and production shall conform thereto within a production tolerance of plus or minus 0.4 percent. Hydrated lime shall be used at the rate of one percent (1%) by weight of the total dry aggregate.

The temperature of the completed mix shall be $235^{\circ} \pm 15^{\circ}\text{F}$.

306.03--Construction Requirements.

306.03.1--Weather Limitations. The asphalt drainage course shall not be placed on a wet or frozen surface, or when weather conditions will prevent proper handling, compacting or finishing of the mixture. No asphalt mixture shall be placed when either the surface or the air temperature is less than 40°F , as measured in the shade and away from any heat source.

306.03.2--Stockpiling. Aggregates shall be reclaimed from the stockpile so as to minimize segregation. Aggregates that have been mixed with earth or foreign material, or become coated with undesirable material shall not be used.

306.03.3--Asphalt Mixing Plant. The asphalt mixing plant for asphalt drainage course shall conform to the requirements of Subsection 401.03.2.

306.03.4--Blank.

306.03.5--Blank.

306.03.6--Hauling Equipment. Hauling equipment shall conform to the requirements of Subsection 401.03.3.

306.03.7--Spreading Equipment. The asphalt mixture shall be spread with a bituminous paver meeting the requirements of Subsection 401.03.4.

306.03.8--Rollers. Rollers shall conform to Subsection 401.03.5 with the following exceptions:

- (a) Pneumatic-tired rollers shall not be used.
- (b) Rollers shall not weigh less than eight (8) tons nor more than 12 tons.
- (c) Vibratory rollers, if used, shall only be operated in the static mode.

306.03.9--Spreading and Finishing. Asphalt drainage course mixture shall be deposited and spread on an approved surface. On areas where irregularities or unavoidable obstacles preclude spreading by mechanical equipment, the mixture

shall be deposited, spread, raked and luted by hand tools.

Unless otherwise noted, the asphalt drainage course shall be spread and compacted in one layer to a 4-inch thickness.

306.03.10--Compaction. Compaction shall consist of rolling by vibratory rollers operated in the static mode or steel-wheeled tandem rollers. Compaction shall be achieved by the application of 1 to 3 complete roller coverages with a steel-wheel, two-axle tandem roller weighing not less than eight (8) tons nor more than 12 tons, as directed by the Engineer. Compaction shall not begin until the temperature of the mixture has cooled to less than 150° F and shall be completed before the mixture is less than 100°F. Asphalt drainage course shall not be cooled with water.

306.03.11--Surface Tolerance. The surface, excluding shoulders, will be tested after final rolling at selected locations using a 10-foot straightedge. The variation of the surface between any two contacts with the surface shall not exceed 3/8 of an inch. All bumps or depressions exceeding this requirement shall be corrected by removing defective work and replacing with new material as directed at no additional cost to the State. All areas requiring removal and replacement shall meet the above surface tolerance.

306.03.12--Thickness Requirements. The maximum allowable deficiency shall be 3/8 of an inch. When the thickness deficiency exceeds 3/8 of an inch, the Contractor shall remove the deficient material and replace at no additional cost to the State.

When stringline grade controls are eliminated for the placement of the asphalt drainage course, the thickness shall be determined by cores taken from the completed pavement in accordance with Subsection 403.03.3. When the thickness deficiency exceeds 3/8 of an inch, payment will be made on a pro rata basis of the required thickness.

Example based on a 4-inch required thickness:

Measured thickness = 3.0"
Minimum allowable thickness = 3.625" (3 5/8")

Payment = $\frac{3.0}{3.625}$ = Eighty-three percent (83%) of the bid item price

306.03.13--Construction Traffic and Equipment Restriction. Construction traffic and equipment operating on the completed asphalt drainage course shall be restricted to only that directly involved in placement of the pavement layer on the asphalt drainage course. The asphalt drainage course shall not be used as a haul road for delivery of materials. Trucks delivering paving materials shall enter immediately in front of the paver and after emptying, shall depart

immediately therefrom. Twisting and turning traffic shall not be allowed. The Contractor shall protect the asphalt drainage course from becoming clogged with dirt or foreign materials resulting from the operation of construction traffic and equipment. Damage to asphalt drainage course by construction traffic and equipment shall be corrected through repair or replacement of the damaged area at no additional cost to the State.

306.04--Method of Measurement. Asphalt drainage course will be measured by the square yard. Measurement will be determined by multiplying the width of the drainage course by the length of the drainage course. The width for measurement will be the plan width, including widening where called for, or as otherwise authorized by the Engineer. The length will be measured horizontally in accordance with Section 109.

306.05--Basis of Payment. Asphalt drainage course, measured as prescribed above, will be paid for at the contract unit price per square yard and shall be full compensation for furnishing all labor, equipment, materials, tools, and supplies and for all other costs including producing, screening, loading, hauling, stockpiling the asphalt drainage course aggregate, furnishing the asphalt cement, mixing, spreading, compacting the asphalt drainage course, and all other work necessary for the construction of the asphalt drainage course.

Payment will be made under:

306-A: Asphalt Drainage Course - per square yard

SECTION 307 - LIME TREATED COURSES

307.01--Description. This work consists of constructing one or more courses of a mixture of soil, hydrated lime and water, or a mixture of soil and hydrated lime slurry in accordance with these specifications and in reasonably close conformity with the lines, grades, thicknesses, and typical cross sections shown on the plans or established by the Engineer. When lime slurry is used the Contractor shall mix hydrated lime with water to produce lime slurry or, at the Contractor's option, produce lime slurry at the job site by the use of equipment specifically manufactured for the slaking of quick lime.

The use of quick lime by the dry application method will not be allowed unless the lime meets the requirements of Subsection 714.03.3.2 for Dry Quick Lime.

The work shall include preparation of the roadbed, incorporation of lime or lime slurry, and processing to the proper grade, section and density in accordance with one of the following methods:

Class A lime treatment shall consist of spreading and incorporating the

specified percentage of lime in two increments in the following sequence: spreading the first increment, initial mixing, mellowing, spreading the second increment, final mixing, compacting, and finishing.

Class B lime treatment shall consist of spreading the specified percentage of lime, initial mixing, mellowing, final mixing, compacting, and finishing.

Class C lime treatment shall consist of spreading the specified percentage of lime, mixing, compacting, and finishing.

Occasionally, the scheduling of contract lettings results in advertising a project before the final soil profile is available, and it is not possible to determine, prior to advertising, the precise class of lime treatment required. Design considerations, therefore, sometimes necessitate changing the class(es) of lime treatment in order to obtain the contemplated structural qualities without unnecessary cost.

The Department reserves the right to modify by Supplemental Agreement or Quantity Adjustment the class of treatment or to eliminate lime treatment from certain sections or to add other sections for lime treatment depending on the results of soil tests.

307.02--Materials.

307.02.1--Materials to be Treated. The material to be treated shall consist of existing roadbed material or material added as directed. Particles of aggregate retained on a three-inch sieve and deleterious substances such as roots, stumps, grass turfs, and other vegetable matter shall be removed from the soil. Material considered by the Engineer to be unsuitable for stabilization shall be removed and replaced with suitable material.

307.02.2--Water. Water used in this construction shall meet the requirements of Subsection 714.01.3.

307.02.3--Lime. Lime shall be either a commercial dry hydrated lime or a commercial dry, granular or pelletized quick lime meeting the applicable requirements of Subsection 714.03. When bulk lime is used, the Contractor shall provide means suitable to the Engineer for applying. The Engineer shall weigh shipments at random for verification of bulk lime quantities.

307.02.4--Curing Seals. Curing seal shall be Emulsified Asphalt, Grade EA-1, SS-1, CMS-2h, or MS-2h meeting the applicable requirements of Section 702.

307.02.5--Soil-Lime Design. The design of soil-lime courses shall be performed by the MDOT Central Laboratory.

307.03--Construction Requirements.

307.03.1--General. Quantities and percentages of lime shown on the plans and in the proposal are based on preliminary soil investigations and dry laboratory sample tests. The actual application rates will be established from tests made just prior to beginning treatment. The Contractor is advised that the estimated quantity of lime is based on application rates of hydrated lime.

It is necessary that lime treated materials be kept moist at all times. It shall be the Contractor's responsibility to provide sufficient equipment and keep all partially constructed or completed lime stabilized layers sufficiently and continually moist until a succeeding layer has been placed thereon or until the project is released from maintenance.

The first section of each mixing operation, both initial and final, will serve as a test section. The length of the test section will be determined by the capabilities of the equipment provided to perform the work, but not less than 350 linear feet nor more than 500 linear feet for the designated width. The Engineer and the Contractor will evaluate the results of the test section in relation to contract requirements. In case the Engineer determines the work is not satisfactory, the Contractor's procedures shall be revised and augment or replace equipment as necessary to assure work is completed in accordance with the contract and shall correct all deficient work at no additional cost to the State.

Also within the test section and only when the dry-application method of quicklime is used, a sample of the soil-lime-water mixture shall be taken after the completion of the mixing operation. This sample shall be taken, by the Contractor, to an independent testing laboratory to determine, using the X-ray Diffraction Test or the Titration Analysis Test, the percent of hydration. After the completion of the test section, the Contractor shall not continue operations until the results of the test sample have been determined. The Contractor shall provide the Engineer with three copies of a certified test report showing that the non-hydrated content of the sample has not exceeded one percent (1.0%) of the total mix. Should the sample not meet the hydration requirements, the Contractor shall re-mix the section and add sufficient water until satisfactory results are achieved. All testing costs associated with determining the hydration efficiency of the sample(s) will be at no additional cost to the State. MDOT reserves the right to make hydration verification checks of the soil-lime-water mixture at any time.

307.03.2--Equipment. The methods and equipment used in performing the work shall conform to the requirements of Subsection 108.05. Equipment necessary for proper prosecution of the work shall be on the project and approved by the Engineer prior to its use.

When bulk lime is used and application of lime is made from equipment other than the delivery transport, batch-type or platform scales meeting the requirements of Subsection 401.03.2.1.11, respectively, shall be provided at

approved locations on or near the project.

When bulk lime is used, the Contractor shall provide approved mechanical spreader(s) having adjustable strike-off gate(s), or other approved spreading equipment constructed so as to provide positive control of the spread. Approval of a spreader will be contingent upon its known or demonstrated ability to make distribution of lime within the tolerances allowable.

Mixing and scarifying equipment shall be capable of positive depth control. Mixing shall be performed with approved rotary-type mixers or other approved equipment.

Rollers shall be of sufficient number, type, size, and weight to accomplish the required compaction.

The Contractor may use approved alternate equipment provided it produces work meeting the requirements of these specifications.

307.03.3--Preparation of Grade. Before treatment, the roadbed shall be prepared in accordance with the requirements of Section 321.

Prior to the application of dry hydrated lime, a light windrow shall be bladed along the edges of the area to be treated, or the surface on which the lime is to be applied shall be scarified to retain the spread.

Prior to the application of slurry, the full width of the area shall be scarified or partially pulverized to the depth necessary to retain the lime slurry until it has been incorporated.

The depth of scarification shall be carefully controlled so that the surface of the roadbed below the scarified material will remain undisturbed and conform to the established cross section.

307.03.4--Application of Lime. The rate of application of lime shall be as specified. The first application for Class A treatment shall not be made after October 15, and no lime shall be applied between November 1 and March 1 without written authorization from the Engineer.

Lime shall not be applied unless the temperature in the shade is at least 40°F and is expected to remain at least 40°F during the mixing period. In no case shall lime be applied on a frozen foundation.

Application of lime shall be accomplished by either an approved "dry application" or "slurry application" method.

The following guide lines will govern the acceptability of the method to be used:

Dry Application. Lime applied by this method shall be spread uniformly and shall be sprinkled with sufficient water to prevent loss of lime by wind. Spreading of lime when wind and weather conditions are unfavorable will not be permitted nor will spreading of lime by motor patrol be acceptable.

The Department reserves the right to check, at any time, the dispersion of quick lime dust in the atmosphere. At no time shall the atmosphere dispersion of quick lime dust exceed a rate of $30,000 \mu\text{g}/\text{m}^3$, measured at a distance of 100 feet.

Slurry Application. Lime applied by this method shall be mixed with water in approved agitation equipment and applied to the roadbed as a thin water suspension or slurry. The distributing equipment shall be equipped to provide continuous agitation of the slurry until applied on the roadbed. The proportion of lime shall be such that the "Dry Solids Content" shall be at least 30 percent by weight.

The distribution of lime at the rate specified shall be attained by one or more passes over a measured section until the specified percentage of lime has been spread. After each successive pass the material shall be incorporated into the soil with the mixing equipment. Additional water, if necessary, shall be added and mixed into the mass to hasten mellowing.

Payment will not be made for lime that has been spread and exposed for a period of six hours or more before mixing. Such areas shall be treated again with the full required rate of application.

Additional lime shall be added at the Contractor's expense to any section on which excessive lime loss has occurred due to washing or blowing, prior to mixing.

The quantity of lime applied on a section shall be spread uniformly and shall not vary more than plus or minus five percent of the quantity ordered. No payment will be made for lime application exceeding the five percent plus tolerance. When the quantity applied is deficient by more than five percent, additional lime shall be applied prior to mixing.

307.03.5--Mixing.

307.03.5.1--Initial Mixing. For Class A and Class B treatments, the lime and water shall be incorporated uniformly into the soil. The mixing and watering operation shall be continued until a homogeneous mixture that will pass a three-inch sieve is obtained. After satisfactory mixing is obtained, the layer shall be reshaped to line, grade, and section and sealed with a light roller no later than the next day following mixing. The sealed mixture shall then mellow for the period specified in the lime mix design furnished by the Central Laboratory. The

mellowing period will be measured in degree days. This period will not be less than five (5) nor more than 20 calendar days. The temperature to be used to determine the degree days mellowing period will be the average of the high and low temperatures for each day of the mellowing period. In the event the average is 40°F or less, that day will not be used in computing the degree days mellowing period. The recommended degree days for the mellowing period may be reduced by the Engineer provided pulverization during final mixing is documented by sieve analysis.

During the mellowing period the partially treated course or layer shall be kept moist by sprinkling. All sections on which the surface becomes dry during the mellowing period shall be reprocessed to the satisfaction of the Engineer or reconstructed in accordance with these specifications.

For Class C treatment, the lime and water shall be incorporated uniformly into the soil. The mixing and water application shall be continued until a homogeneous mixture of which 100 percent of the material by dry weight, exclusive of gravel and stone, will pass a 1-inch sieve and 60 percent will pass a No. 4 sieve. At the completion of moist mixing and during the compaction operations, the percentage of moisture shall be that necessary to obtain the required density. No mellowing period will be required or permitted, and compaction shall begin immediately. The mixing, water application, and final compaction shall be completed during the same work day.

307.03.5.2--Final Mixing. After the mellowing period of Classes A and B treatments, the layer shall be scarified and, in the case of Class A treatment, the second application of lime added. The layer shall then be remixed as prescribed in the initial mixing operations. Mixing shall continue until 100 percent of material by dry weight, exclusive of gravel and stone, will pass a 1-inch sieve and 60 percent will pass a No. 4 sieve. At the end of mixing and during compaction, the moisture in the mixture shall be that necessary to obtain the required density.

307.03.5.3--Thickness and Width Requirements. For the purpose of determining reasonable conformity with the designated thickness of a course, it shall be understood that the depth of a course shall not vary from the designated thickness by more than plus or minus one inch. All sections not in reasonably close conformity because of deficient thickness shall be reprocessed to meet specification requirements. All sections not in reasonably close conformity because of excess thickness shall have additional lime applied and shall be reprocessed to meet specification requirements at no additional cost to the State.

For the purpose of determining reasonable conformity with the designated width of a course, it shall be understood that the width of a course shall not vary from the designated edge lines by more than plus or minus three inches.

307.03.6--Compaction. Compaction of the mixture shall begin immediately after the required mixing operation has been completed.

Compaction shall be completed during same day it was begun and shall provide uniform and continuous compaction from bottom to top of the layer. The mixture shall be aerated or watered as necessary to provide the needed moisture content for obtaining the required density.

Throughout the entire compaction operation, depressions, defective areas, and soft spots which develop shall be corrected immediately by scarifying the area, adding lime when required, or removing the material, and reshaping and compacting in accordance with these specifications at no additional cost to the State.

Density tests will be performed in accordance with the methods as provided in Subsections 700.03 and 700.04.

Determination of acceptance of compaction of Classes A, B, and C lime treated design soil will be performed on a lot to lot basis. Each lot will be 2,500 linear feet per layer placed. At the discretion of the Engineer, a residual portion of a lot completed during a day's operation may be considered as a separate lot or may be included in the previous or subsequent lot, except that any day's operation of less than one full lot will be considered a lot.

The lot will be divided into five approximately equal sublots with one density test taken at random in each subplot. The average of the five density tests shall equal or exceed 95.0 percent with no single density test below 91.0 percent. Sublots with a density below 91.0 percent shall be corrected at no additional cost to the State and retested for acceptance.

307.03.7--Finishing, Curing, Protection, and Maintaining. The surface of the layer shall be smooth and conform to the lines, grades, and typical cross sections shown on the plans or established by the Engineer. Surface requirements shall be as specified in Subsection 321.03.7.

Each complete course shall be covered with a bituminous curing seal as soon as possible but no later than 24 hours after completion. The surface shall be sealed with one of the specified bituminous materials applied by a pressure distributor at the rate of 0.10 to 0.25 gallon per square yard or as directed by the Engineer. The bituminous material shall be heated or otherwise prepared to insure uniform distribution. Should the Contractor fail to seal the lime-fly ash course within the time specified, the Engineer will suspend all other work and withhold payment of the current estimate(s) until all damages resulting there from is corrected and the treated course is sealed.

A subsequent course shall not be placed on the sealed course for at least seven

(7) calendar days. During this 7-day period, the treated course shall not be subjected to any type of traffic and equipment.

The Contractor shall maintain the treated course and the curing seal in a satisfactory condition until covered by a subsequent course. Protection shall include immediate repairs of any surface irregularities or other defects that may occur or develop. It shall be the Contractor's responsibility to control traffic and equipment loads to avoid damage and to guard against freezing of the treated material.

All damage resulting from the Contractor's failure to protect and cure the treated course as specified herein or from freezing that may occur prior to being covered with the next course shall be corrected at no additional cost to the State.

Lime treated courses shall be corrected by reprocessing with Class C treatment to such depth as necessary to restore the CBR (California Bearing Ratio) of the damaged material to that shown on the mix design, all at no additional cost to the State. The Contractor shall add the necessary quantity of lime, as determined by the Central Laboratory, and in no case shall it be less than two percent by weight.

307.04--Method of Measurement. Soil-lime-water mixing will be measured by the square yard, complete in place, for each course designated on the plans and for which quantities have been included in the contract.

If a change in the class of treatment is made, as provided in Subsection 307.01, each class of treatment constructed will be measured separately.

Lime incorporated in accepted treatment will be measured by the ton. Lime in excess of the tolerance allowable and all lime required to be furnished by the Contractor at no additional cost to the State will be deducted from measured quantities.

The basis of pay for jobsite slaked lime slurry shall be the "calculated method" using the certified lime purity for each truckload as follows:

$$\text{Pure Quick Lime (Ca O)} \times 1.32 = \text{Hydrated Lime (Ca (OH)}_2\text{)}$$

$$\text{Quick Lime delivered} \times \% \text{ purity} \times 1.32 = A$$

$$\text{Quick Lime delivered} \times \% \text{ inert material} \times 1.0 = B$$

$$A + B = \text{Total Hydrated Lime produced (Pay Quantity)}$$

The basis of pay for quick lime by the dry application method shall be the "calculated method" using the certified lime purity for each truckload as follows:

Pure Quick Lime (Ca O) x 1.32 = Hydrated Lime (Ca (OH)₂)

Quick Lime delivered x % purity X 1.32 = A

QUICK LIME DELIVERED X % INERT MATERIAL X 1.0 = B

A + B = Total Hydrated Lime produced (Pay Quantity)

Water and curing seal will not be measured for separate payment.

307.05--Basis of Payment. Soil-lime-water mixing and lime, measured as provided above, will be paid for as follows:

Soil-lime-water mixing of the class(es) specified or ordered will be paid for at the contract unit price, or adjusted unit price as provided herein, per square yard.

Quantities of soil-lime-water mixing changed as ordered will be paid for at the contract unit price for soil-lime-water mixing plus or minus, as applicable, the amount indicated in the following schedule:

SCHEDULE FOR 6" DEPTH⁽¹⁾

<u>Class Ordered</u>	<u>Unit Price Per Square Yard</u>
A	Class B Unit Price Bid Plus \$0.05
A	Class C Unit Price Bid Plus \$0.10
B	Class A Unit Price Bid Minus \$0.05
B	Class C Unit Price Bid Plus \$0.05
C	Class A Unit Price Bid Minus \$0.10
C	Class B Unit Price Bid Minus \$0.05

SCHEDULE FOR 8" DEPTH⁽¹⁾

<u>Class Ordered</u>	<u>Unit Price Per Square Yard</u>
A	Class B Unit Price Bid Plus \$0.10
A	Class C Unit Price Bid Plus \$0.15
B	Class A Unit Price Bid Minus \$0.10
B	Class C Unit Price Bid Plus \$0.05
C	Class A Unit Price Bid Minus \$0.15
C	Class B Unit Price Bid Minus \$0.05

SCHEDULE FOR 10" DEPTH⁽¹⁾

<u>Class Ordered</u>	<u>Unit Price Per Square Yard</u>
A	Class 'B' unit price bid plus \$0.15
A	Class 'C' unit price bid plus \$0.20
B	Class 'A' unit price bid minus \$0.15
B	Class 'C' unit price bid plus \$0.05
C	Class 'A' unit price bid minus \$0.20
C	Class 'B' unit price bid minus \$0.05

(1) When the Schedule and classes bid in the contract result in two unit prices for an ordered class, the smaller of the two is to be used as the established unit price.

Lime will be paid for at the contract unit price per ton.

Payment for removal and disposal of unsuitable material will be made under other provisions of the contract.

The prices thus paid shall be full compensation for completing the work.

Payment will be made under:

- 307-A: ____ " Soil-Lime-Water Mixing, Class A - per square yard
- 307-B: ____ " Soil-Lime-Water Mixing, Class B - per square yard

307-C: ____" Soil-Lime-Water Mixing, Class C

- per square yard

307-D: Lime

- per ton

SECTION 308 - PORTLAND CEMENT TREATED COURSES

308.01--Description. This work consists of constructing one or more courses of a mixture of cement, soil or soil aggregate, and water in accordance with these specifications and in reasonably close conformity with the lines, grades, and typical cross sections shown on the plans or established by the Engineer.

308.02--Materials.

308.02.1--Materials to be Treated. The materials to be treated shall consist of materials in place or placed under this contract.

308.02.2--Water. Water shall conform to the requirements of Subsection 714.01.3.

308.02.3--Portland Cement. Cement shall conform to the requirements of Section 701.

When bulk cement is used, the Contractor shall provide means suitable to the Engineer for applying. The Engineer shall weigh shipments at random for verification of bulk cement quantities.

When bag cement is furnished, the bag shall bear the manufacturer's certified weight. Bags varying more than five percent from the certified weight will be rejected, and the average weight of bags in any shipment, determined by weighing 50 bags taken at random, shall not be less than the certified weight.

Cement shall be stored and handled in closed, weatherproof containers until distribution to the section of road being processed. If storage bins are used, they shall be completely enclosed.

308.02.4--Curing Seals. Curing seal shall be Emulsified Asphalt, Grade EA-1, SS-1, CMS-2h, or MS-2h meeting the applicable requirements of Section 702.

308.02.5--Soil-Cement Design. The design of soil-cement courses shall be performed by the Central Laboratory.

308.03--Construction Requirements.

308.03.1--General. The intent of these specifications is to provide for a cement treated course of designated thickness consisting of a uniform mixture of cement,

soil or soil aggregate, and water; constructed at the required moisture content to the required density; free of laminations, construction cracks, ridges, or loose material; and with a smooth, closely knit surface meeting the requirements set out in Section 321.

A course whose compacted thickness is designated to be more than eight inches, shall be constructed in two or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed eight inches.

Immediately prior to placement of a course to be cement treated on an in place cement treated course, the in place course shall be thoroughly moistened.

Except as necessary to provide the required curing and maintenance of traffic, all equipment and traffic shall be kept off each completed cement treated course until it is thoroughly cured. Unless otherwise specified, the curing period shall be seven days exclusive of days during which the temperature falls below 35°F.

Prior to joining a previous day's work, or work more than two hours old, a vertical construction joint, normal to the centerline of the roadbed, shall be made in the old work. The joint shall be moistened if dry. Additional processing shall not be started until the construction joint has been approved by the Engineer.

When vertical longitudinal joints are specified or permitted, the joints shall be constructed parallel to the centerline by cutting into the existing edge for a sufficient distance to provide a vertical face for the depth of the course. The material cut away may be disposed of by spreading in a thin layer on the adjacent lane to be constructed, or otherwise disposed of in a satisfactory manner. If dry, cut joints shall be moistened immediately in advance of placing fresh mixture adjacent to them.

On multi-lane construction, the Contractor may construct temporary crossovers at locations approved by the Engineer between roadway lanes to facilitate construction operations. The crossovers shall be built, removed, the median restored to section, and all erosion control items completed in accordance with the requirements of the specifications without extra cost to the State.

The first section of each cement treated course constructed will serve as a test section. The length of the test section will be determined by the capability of the equipment provided to perform the work, but not less than 350 linear feet nor more than 500 linear feet for the designated width. The Engineer and the Contractor will evaluate results of the test section in relation to contract requirements. In case the Engineer determines the work is not satisfactory, the Contractor's procedures shall be revised and augment or replace equipment as necessary to assure work completed in accordance with the contract, and shall correct all deficient work at no additional cost to the State.

308.03.2--Equipment.

308.03.2.1--General. Equipment necessary for the proper prosecution of the work shall be on the project and approved by the Engineer prior to its use.

When bulk cement is used and application of cement is made from equipment other than the delivery transport, batch-type or platform scales meeting the requirements of Subsection 401.03.2.1.11, respectively, shall be provided at approved locations on or near the project.

Approval of cement spreaders will be contingent upon their known or demonstrated ability to make distribution of cement within allowable tolerances.

Watering equipment shall be pressurized, have one or more spray bars with suitable nozzle openings, and have positive controls for applying varying quantities of water.

Mixing shall be performed with multiple pass mixers, single pass mixers, traveling mixing plants, or central mixing plants, as specified in the contract.

Mixing and scarifying equipment for the road mix methods shall be capable of positive depth control.

Rollers shall be of sufficient number, type, size, and weight to accomplish the required compaction.

Leakage of water, oil, grease, or other liquids from equipment shall be immediately corrected, or the leaking equipment removed from the work and replaced with satisfactory equipment.

308.03.2.2--Multiple Pass Mixers. Multiple pass mixers shall be the rotary-type with sufficient tines and so constructed and operable as to obtain by multiple passes uniform mixture of the cement, soil-aggregate, and water for the full depth of the course.

308.03.2.3--Single Pass Mixers. Single pass mixers shall be the pugmill type so constructed and operable as to meter the required quantity of water through a pressurized spray and obtain by a single pass a uniform mixture of the cement, soil or soil-aggregate, and water for the full depth of the course.

308.03.2.4--Traveling Plant Mixers. Traveling mixing plants shall be either of the type which will pulverize the material to be treated and mix it and cement with the proper quantity of water without picking the materials up from the roadway, or of the pugmill type which elevates the materials into a pugmill for mixing. The plant shall be equipped with a device which will accurately control and measure the quantity of water used. Worn scarifying and mixing parts shall

be replaced, and extra parts shall be available for replacements.

308.03.2.5--Central Plant Mixers. Central mixing plants shall be either the batch type using revolving blade or rotary drum mixers or the continuous mixing type. The cement, soil or soil-aggregate, and water may be proportioned either by weight or by volume. There shall be means by which the Engineer can readily verify the proportions in each batch or the rate of flow for continuous mixing.

The charge and mixing time in a batch mixer, or the rate of feed to a continuous mixer, shall be such as to obtain complete mixing of all the material. Dead areas in the mixer, in which the material does not move or is not sufficiently agitated, shall be corrected. The plant shall deliver a uniform mixture meeting all specified requirements.

308.03.3--Road Mix Method. When the road mix method is used, no hauling of materials for a subsequent course will be permitted directly on a completed cement treated course. Placing of material for a higher course shall be accomplished as outlined in Subsection 321.03. Materials for a higher course shall be kept bladed down as it is placed, and hauled over with truck traffic being distributed over its entire width.

Where reconstruction is required, it shall be for the full depth and width of the deficient section. The adding of a thin layer or strip of cement treated material will not be permitted. All sections to be reconstructed later than the two-hour period allowed for initial compaction shall have additional cement. When reconstruction is to be performed within 48 hours after the initial application of cement, 50 percent of the original quantity of cement shall be added. When reconstruction is to be later than 48 hours after the initial application of cement, an engineering study will be made, and the Engineer will specify the additional quantity of cement to be added, or the Engineer may require the total removal of the deficient work. If removal is required, a course meeting the requirements of the contract shall be constructed with new materials.

In all cases where reconstruction is performed by the addition of cement, the cement, in place materials, and water shall be thoroughly mixed, processed, compacted, and finished in accordance with the requirements of the contract.

Where deficient work is removed, the removal and disposal shall be performed in a manner satisfactory to the Engineer, and all materials shall be replaced and a new course constructed in accordance with the requirements of the contract. The furnishing of all materials for and all reconstruction shall be performed by the Contractor at no additional cost to the State.

308.03.4--Central Plant Mix Method. When the central plant mix method is used, material for a higher course may be hauled directly on a completed and

properly cured cement treated course for the minimum distance necessary as referenced in Subsection 321.03. The Contractor shall be fully responsible for all damages to the course.

Prior to placement of a course processed by the plant mix method, the Contractor shall have made satisfactory provisions for completing the section to specified requirements. To comply with these requirements, the Contractor shall, if necessary, use material(s) specified for contiguous shoulder construction.

The mixture shall be hauled to the roadway in trucks equipped with protective covers. The mixture shall be uniformly placed on a moistened foundation by full-width spreader, or partial-width spreaders working in echelon and spaced close enough together to place the entire course in one operation. The elapsed time between the start of moist mixing and the start of compaction on the roadway shall not exceed 60 minutes. The elapsed time between placement of cement treated material in adjacent lanes shall not exceed 30 minutes, except where longitudinal construction joints are specified, or when joints are permitted by the Engineer in case of emergency. In the latter case longitudinal joints conforming to the requirements of these specifications will be permitted only to allow placement of material in transit at the time of the emergency.

The material shall be placed, shaped, and compacted so that the completed course will be uniform, smooth, and conform to all of the requirements specified.

Dumping of the mixture in piles or windrows and spreading with a motor grader or similar equipment will not be permitted except where the Engineer determines that such spreading is reasonable, as in the case of small areas inaccessible to mechanical spreaders.

In all cases where reconstruction is required, the deficient work shall be removed, disposed of, and replaced with materials meeting the requirements of these specifications. Reconstruction shall be for the full depth and width of the deficient section, except where the Engineer determines that partial reconstruction will be sufficient, the Engineer may authorize in writing that reconstruction may be made on the defined partial section in accordance with the provisions and requirements for reconstruction under Subsection 308.03.3 at no additional cost to the State.

308.03.5--Preparation of Grade. Prior to construction or reconstruction, the foundation shall be prepared in accordance with the requirements of Section 321. The tolerance from design grade immediately prior to spreading cement shall be minus one inch for design soils and plus or minus one-half inch for bases.

308.03.6--Preparation of Materials. Particles of aggregates larger than those passing a three-inch sieve and deleterious substances, such as roots, sticks, grass turfs, or other vegetable matter shall be removed.

308.03.7--Application of Cement.

308.03.7.1--General. The percentages of cement shown on the plans are based on preliminary soil investigation and are approximate. Before construction is started, the Department will make the necessary tests to determine the percentages of cement required.

The quantity of cement spread on a section or added through a central plant shall not vary more than five percent of the quantity ordered. When the quantity spread is deficient by more than five percent, an additional application of cement shall be uniformly spread over the entire section to correct the deficiency prior to mixing operation. Cement, including that applied to correct deficiency, in excess of the allowable plus tolerance will be deducted from measured quantities.

When the quantity of cement added through a central plant is deficient by more than the allowable tolerance, all mixtures produced with deficient cement will be considered unacceptable.

When the quantity of cement added through a central plant is in excess of the allowable tolerance, the excess will be computed by the Engineer and deducted from measured quantities.

308.03.7.2--Weather Limitations. No cement or cement treated material shall be placed in Districts 1, 2, 3, and 5 between November 15 and March 15, nor in Districts 6 and 7 between December 1 and March 1. Cement or cement treated material shall not be applied when the temperature is below 40°F nor when the Engineer determines, based on the latest information available from the National Weather Service, that probable freezing will occur within seven days in the area in which the project is located. No cement or cement treated material shall be placed on a frozen foundation, nor shall cement be mixed with frozen material.

308.03.7.3--Road Mix Method. After preparation of the grade, the required quantity of cement shall be spread uniformly over the grade. Cement lost or damaged from any cause shall be replaced without additional compensation before mixing is started.

The cement spreader shall be positioned by string lines or other approved methods during spreading to insure proper application of cement. All cement deposited into the spreader shall be weighed so that the pay quantity and the rate of spread can be determined.

In small areas, bag distribution in an approved manner, will be permitted. When bag distribution is made, a spike-toothed harrow or other equipment, which will not drag or blade the cement out of desired position but will strike it off at a uniform height, may be used. A motor grader, or other blade-type equipment, shall not be used to spread the cement.

Except for final finishing, all processing shall be completed within three hours after spreading. Except by written permission of the Engineer, no cement shall be spread on an area which cannot be completely processed, including all final surface finishing, during the same day.

No cement shall be applied when the moisture content of the material to be processed exceeds the optimum for the soil-cement mixture by more than two percentage points. No cement shall be spread when free water is on the surface of the roadbed.

No equipment except that used in spreading or mixing shall be allowed to pass over the freshly spread cement until mixed with the material to be treated.

308.03.7.4--Central Plant Mix Method. The cement shall be uniformly metered into the soil or soil-aggregate in the specified proportions and at the time and in the manner that the application of water will not cause formation of cement balls.

308.03.8--Mixing.

308.03.8.1--General. Unless otherwise indicated, cement treated materials may be processed by any one or combination of the mixing equipment described in Subsection 308.03.2. Where the bid schedule indicates single pass mixers, traveling plant mixers or central plant mixers will also be permitted. Where the bid schedule indicates traveling plant mixers, central plant mixers will also be permitted.

Preliminary scarifying shall be carefully controlled and the undisturbed foundation shall have a crown conforming as nearly as practicable to that of the finished course. Subject to the moisture limitations prior to spreading cement as referenced in Subsection 308.03.7.3, soil to be processed may be pre-wet prior to spreading cement. All additional water required to bring the section being processed to the required moisture content shall be applied within one hour after the beginning of mixing.

Mixing shall be carefully controlled so that the bottom of the course will conform as closely as possible to the design grade and cross section.

When the plans indicate multiple courses to be constructed, the material for each course shall be mixed separately. Multiple courses shall be constructed so that each course is in direct contact with the underlying course, and an unmixed cushion of material between layers will not be permitted.

Each increment of water added during mixing shall be incorporated into the mixture for the full depth, and no portion of the mixture shall remain undisturbed for more than 30 minutes prior to compaction. Mixing and water application

shall be continued as necessary to produce a completed mixture of uniform moisture content. Particular care shall be exercised to insure satisfactory moisture distribution along the edges of the section, and to avoid the addition of excess water.

The soil-cement mixture for subgrade and base construction shall be pulverized to the extent that 100 percent of the material, exclusive of gravel and stone, by dry weight will pass a 1-inch sieve and a minimum of 75 percent will pass a No. 4 sieve.

The soil-cement mixture for design soils shall be pulverized to the extent that 100 percent of the material, exclusive of gravel and stone, by dry weight will pass a 1-inch sieve and a minimum of 60 percent will pass No. 4 sieve.

When the un-compacted mixture is wetted by rain to the extent the average moisture content at the time for final compaction exceeds optimum by more than two percent, or if any of the operations after the start of mixing are interrupted continuously for more than 30 minutes, the entire area affected shall be reconstructed in accordance with these specifications at no additional cost to the State.

308.03.8.2--Road Mix Methods.

308.03.8.2.1--Multiple Pass Mixing. After the cement has been spread, it shall be mixed with the material to be treated without the addition of water. Immediately after the preliminary mixing of cement and soil or soil-aggregate, water as necessary shall be applied in the quantity required and incorporated uniformly into the mixture for the full depth.

After the last increment of water has been applied, mixing shall continue as necessary until a uniform mixture of cement, soil or soil-aggregate, and water for the full depth of the course has been obtained.

308.03.8.2.2--Single Pass Mixing. After the cement has been spread, it shall be mixed by a mixer which applies water and mixes in one simultaneous and continuous operation. The mixer shall be operated at a speed that will produce a uniform mixture meeting all specified requirements for the full depth of the course.

308.03.8.2.3--Traveling Plant Mixing. After the cement has been spread, it shall be mixed with a traveling plant mixer that will apply the proper quantity of water and produce in one simultaneous and continuous operation a mixture meeting all the requirements of the contract.

308.03.8.3--Central Plant Method. Mixing in a central plant shall continue until a homogeneous mixture meeting specified requirements is obtained, and no

varying appearance is evident. The mixing time may be adjusted by the Engineer as necessary.

308.03.9--Shaping, Compacting, and Finishing.

308.03.9.1--General. The mixed material shall be shaped as required immediately after mixing, or delivery to the roadbed in the case of central plant mixed material. Initial compaction shall begin immediately, and machining and compacting shall continue until the entire depth and width of the course is compacted to the required density within two hours of the time of beginning mixing. Compaction shall be by equipment and methods which do not result in lamination.

Areas inaccessible to rollers shall be compacted to the required density by other approved methods.

The addition of thin layers of cement-treated material in order to conform to cross sectional or grade requirements will not be permitted.

Compaction by vibration shall not be performed after the cement has taken its initial set. Vibratory compaction of a section shall be completed within one hour.

During compaction, a spike-tooth harrow or other suitable equipment shall be used as required to prevent lamination.

After the mixture, except the top mulch, is compacted, water shall be added as required to the mulch, and thoroughly mixed with a spike-tooth harrow or its equivalent to bring the mulch to the needed moisture content.

The surface shall then be reshaped to the required lines, grades, and cross section, and if necessary shall be lightly scarified to remove imprints left by the compacting or shaping equipment. The surface shall then be sprinkled as necessary and thoroughly rolled with a pneumatic roller, and if the mixture contains plus No. 4 aggregate, at least one complete coverage of the section shall be made with a steel-wheel tandem roller.

Surface compaction and finishing for the entire section shall be performed in a manner that will produce a smooth, closely knit surface, free from laminations, construction cracks, ridges, or loose material, and conforming to the crown, grade, and lines stipulated within four hours after the beginning of mixing.

Upon completion of compaction, testing will be performed in accordance with Subsections 700.03 and 700.04.

308.03.9.2--Density. Determination of acceptance of compaction of portland cement treated courses for required density will be performed on a lot to lot

basis. Each lot will be each 2,500 linear feet per layer placed. At the discretion of the Engineer, a residual portion of a lot completed during a day's operation may be considered a separate lot or may be included in the previous or subsequent lot, except that any day's operation of less than one full lot will be considered a lot.

The lot will be divided into five approximately equal sublots with one density test taken at random in each subplot. The average of the five (5) density tests shall equal or exceed 98.0 percent with no single density test below 94.0 percent. Sublots with a density below 94.0 percent shall be corrected at no additional cost to the State and retested for acceptance.

For cement treated materials other than for design soils and bases, the required density will be set out elsewhere in the contract.

308.03.9.3--Width, Thickness, and Surface Requirements. For the purpose of determining reasonable conformity with the designated width of a treated course, it shall be understood that the width of a treated course shall not vary from the designated edge lines by more than plus or minus one inch.

For the purpose of determining reasonable conformance with the designated thickness of a treated course, it shall be understood that the depth of a treated course shall not vary from the designated thickness by more than plus or minus one inch.

The finished surface of a treated course shall conform to the requirements shown on the plans, within the tolerances allowable under Section 321.

308.03.10--Protection and Curing. Each completed course shall be covered with a bituminous curing seal as soon as possible but no later than 24 hours after completion. The surface shall be sealed with one of the specified bituminous materials applied by a pressure distributor at the rate of 0.10 to 0.25 gallon per square yard or as directed by the Engineer. The bituminous material shall be heated or otherwise prepared to insure uniform distribution. Should the Contractor fail to seal the treated course within the time specified, the Engineer will suspend all other work and withhold payment of the current estimate(s) until all damages resulting there from is corrected and the treated course is sealed.

A subsequent course shall not be placed on the sealed course for at least seven (7) calendar days. During this 7-day period, the treated course shall not be subjected to any type of traffic and equipment.

The Contractor shall maintain the treated course and the curing seal in a satisfactory condition until covered by a subsequent course. Protection shall include immediate repairs of any surface irregularities or other defects that may occur or develop. It shall be the Contractor's responsibility to control traffic and

equipment loads to avoid damage and to guard against freezing of the treated material.

All damage resulting from the Contractor's failure to protect and cure the treated course as specified herein or from freezing that may occur prior to being covered with the next course shall be corrected at no additional cost to the State.

The Contractor shall submit, for approval of the Engineer, a method of correction that will restore the strength of the damaged material to that originally specified.

308.03.11--Maintenance. The Contractor shall maintain the cement treated course and the curing seal in a satisfactory condition until covered by a subsequent course. Maintenance shall include immediate repairs of surface irregularities or other defects that may occur. It shall be the Contractor's responsibility to control traffic and equipment loads to avoid damage and to guard against freezing of the course. All maintenance shall be performed at the expense of the Contractor and repeated as necessary to keep the cement treated material and the curing seal intact.

308.04--Method of Measurement. Portland cement incorporated in the accepted work, subject to the limitations set out in Subsection 308.03.7.1, will be measured by the ton, as designated, in accordance with the provisions of Section 109.

Accepted soil-cement-water mixing will be measured by the square yard or ton.

Contractor furnished materials will be measured and paid for in accordance with the provisions for the governing pay items shown in the contract.

Water and bituminous materials for the curing seal will not be measured for separate payment.

Unauthorized wastage or usage of any materials, unused materials remaining in stockpiles, and additional materials required for reconstruction of unacceptable work will be deducted from measured quantities. Determination of quantities to be deducted will be made by the method the Engineer considers to be most practicable and equitable, and the Contractor's decision as to the method used shall be final.

308.05--Basis of Payment. Portland cement will be paid for at the contract unit price per ton. Soil-cement-water mixing will be paid for at the contract unit price per square yard or ton, as specified. The prices thus paid shall be full compensation for completing the work.

Payment will be made under:

308-A: Portland Cement

- per ton

308-B: Soil-Cement-Water Mixing, Type* Mixers,
Component

- per square yard
or ton**

* Optional, Single Pass, Multiple Pass, Traveling Plant, or Central Plant.

** Central Plant Mixers Only.

SECTION 309 – CRUSHED STONE DRAINAGE LAYER

309.01--Description. This work shall consist of the construction of a drainage layer composed of a crushed stone laid upon a prepared surface, in accordance with these specifications and in conformity with the lines, grades, thickness, and typical sections shown on the plans.

309.02--Materials. The aggregate shall meet the requirements of Subsection 704.06.

309.03--Construction Requirements.

309.03.1--Weather Limitations. The drainage layer shall not be placed on a wet or frozen surface, or when weather conditions prevent proper handling, compacting or finishing of the mixture.

309.03.2--Stockpiling. Stockpiles shall be constructed and aggregates shall be reclaimed from the stockpile so as to minimize segregation. Aggregates that have been mixed with earth or foreign material, or become coated with undesirable material shall not be used.

309.03.3--Spreading. The drainage layer aggregate shall be spread, as uniformly as possible with a minimum of manipulation to prevent segregation, using an asphalt laydown machine or spreader box with automatic grade controls. On areas where irregularities or unavoidable obstacles preclude spreading by mechanical equipment, the mixture shall be deposited, spread and finished by hand tools.

309.03.4--Compaction. Pneumatic-tired rollers, or vibratory rollers shall be used to provide densification of the material. One or more control strips, minimum of 500 feet in length and 12 feet wide, shall be constructed at the beginning of the work for the purpose of determining project compaction requirements. An additional control strip shall be constructed whenever a change is made in the type or source of material, whenever a change occurs in the composition of the material from the same source, or as directed by the Engineer.

Each control strip shall consist of the same material and thickness as that specified for the completed layer,. Each accepted control strip shall remain in place and become a portion of the completed drainage layer.

The control strip shall be compacted by a minimum of four (4) passes with the compaction equipment. A pass is defined as one passage of any one tire or compacting wheel unit over the entire surface of the layer. Compaction shall continue until no appreciable increase in density is obtained by additional passes, as monitored using a nuclear density gauge, without crushing of aggregate.

No specific percentage of density will be required. The rolling pattern, number of passes, as determined in the control strip shall be used to compact the drainage layer.

309.03.5--Shaping and Finishing. The surface of the drainage layer shall be shaped to the required cross-section. Prior to placement of any HMA lift, all surface deficiencies shall be corrected.

309.03.6--Tolerances. The surface tolerance shall be $\pm 3/8$ inch when tested after final rolling using a 10-foot straightedge at selected locations. Low areas exceeding this requirement shall be corrected by adding material, grading and compacting. A material transfer unit may be required to meet the specified surface tolerances.

The maximum allowable thickness deficiency shall be $3/8$ inch. When the deficiency exceeds this requirement, the thin area shall be corrected by adding material, grading and compacting to proper thickness.

309.03.7--Construction Traffic and Equipment Restriction. Construction traffic and equipment operating on the completed drainage layer shall be restricted to only that directly involved in placement of the first HMA course. The drainage layer shall not be used as a haul road for delivery of materials. Trucks delivering paving materials shall enter immediately in front of the paver and after emptying, shall depart immediately therefrom. Twisting and turning traffic shall not be allowed. The Contractor shall protect the drainage layer from becoming clogged with dirt or foreign materials resulting from the operation of construction traffic and equipment. Damage to drainage layer by construction traffic and equipment shall be corrected through repair or replacement of the damaged area at no additional cost to the State.

309.04--Method of Measurement. Crushed stone drainage layer will be measured by the square yard, cubic yard (LVM), or ton, as indicated in the bid schedule of the contract.

When the method of measurement is by the square yard, the width for measurement will be the plan width, including widening where called for, or as

otherwise authorized in writing by the Engineer. The length will be measured horizontally in accordance with Section 109.

When the method of measurement is by the ton, measurement will be made on the dry unit weight basis. The moisture determination for computing the dry unit weight will be made in accordance with the methods as provided in Subsections 700.03 and 700.04 at least once a day and as many additional times as the Engineer deems necessary

309.05--Basis of Payment. Crushed stone drainage layer, complete in place, accepted and measured as prescribed above, will be paid for at the contract unit price per unit specified in the bid schedule of the contract, and shall be full compensation for furnishing all labor, equipment, materials, tools, and supplies, and for all other costs including producing, screening, loading, hauling, stockpiling the crushed stone drainage layer aggregate; spreading and compacting the drainage layer, and all other work necessary for the construction of the crushed stone drainage layer.

Payment will be made under:

309-A: Crushed Stone Drainage Layer	- per square yard, cubic yard, or ton
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SECTION 310 - MECHANICALLY STABILIZED COURSES

310.01--Description. This work consists of constructing one or more courses by the incorporation of stabilizer aggregate in accordance with these specifications and in reasonably close conformity with the lines, grades, and typical cross sections shown on the plans or established by the Engineer.

310.02--Materials.

310.02.1--Materials to be Stabilized. The material to be stabilized shall consist of base material placed under this contract or under a previous contract.

General conditions governing the use of materials shall be as set out in Section 106.

310.02.2--Stabilizer Aggregates. Stabilizer aggregates of the kind and size specified shall meet the requirements of Subsection 703.20.

310.02.3--Composite Mixture. The composite mixture of mechanically stabilized courses shall be in accordance with the requirements and provisions of Subsection 703.08. In order to obtain the desirable composite mixture, the Engineer may vary the quantity of stabilizer aggregate shown on the plans by as

much as 25 percent.

Acceptance of the composite mixture for conformance to the specification requirements for gradation, liquid limit and plasticity index shall be based on samples obtained from the roadway. A minimum of one random sample shall be obtained for each 1000 linear feet of 24 foot lane. In case a sample fails to meet the requirements of the specifications, additional samples shall be obtained to locate the limits of the non-conforming material. Such non-conforming material shall be corrected by the Contractor, at no additional costs to the State, prior to final acceptance.

310.03--Construction Requirements.

310.03.1--General. The first section of each course to be constructed will serve as a test section. The length of the test section will be determined by the capability of the equipment selected to perform the work, but will be at least 1000 linear feet but not more than 1500 linear feet for the designated width. The Engineer and the Contractor will evaluate results of the test section in relation to contract requirements. In case the Engineer determines the work is not satisfactory, the Contractor shall revise procedures and augment or replace equipment as necessary to assure work completed in accordance with the contract, and shall correct all deficient work at no additional cost to the State.

For the purpose of determining reasonable conformity with the designated width of a course, the width of a course shall not vary from the designated edge lines by more than plus or minus three inches.

Courses designated to be more than eight inches thick shall be constructed in two or more layers of approximately equal thickness. The maximum compacted thickness of any one layer shall not exceed eight inches.

When the plans indicate multiple courses, each course shall be mixed or spread, shaped, and compacted separately. Multiple courses shall be constructed so that each course is in direct contact with the preceding course, and a cushion of unstabilized material between layers will not be permitted.

When material for shoulders is of a different class or type from that specified for the course being constructed, the partial formation of shoulders shall precede the placement of aggregate or plant mixed material. Temporary drainage as necessary through partially constructed shoulders shall be provided and maintained until construction of the contiguous course.

No material shall be placed on or mixed with frozen material.

310.03.2--Equipment. Watering equipment shall have pressurized spray bars with suitable nozzle openings.

Mixing shall be performed with multiple pass mixers, single pass mixers, traveling mixing plants, or central mixing plants. Unless otherwise specified, the type mixer used will be at the option of the Contractor.

Mixing equipment shall meet the applicable requirements of Subsection 308.03.2.

Rollers shall be of sufficient number, type, size, and weight to accomplish the required compaction.

When measurement for payment is to be made by the ton, the Contractor shall furnish approved platform scales capable of weighing the entire loaded vehicle. Scales and their use shall be in accordance with the requirements set out in Subsection 401.03.2.1.11, except they shall be installed at an approved location on or near the project.

310.03.3--Preparation of Grade. Prior to placing material, the foundation shall be prepared in accordance with the requirements of Section 321 for a sufficient distance in advance to insure proper prosecution of the work.

310.03.4--Preparation of Materials. The material to be stabilized shall be reasonably free from clay balls, roots, grass, organic matter, and other deleterious substances.

310.03.5--Application of Stabilizer Aggregate (Road Mix Method). When the roadbed has been prepared and approved, aggregate in the quantity specified shall be uniformly spread.

The Contractor shall provide sufficient equipment and shall organize the work so that the time interval between dumping and spreading of aggregate and subsequent incorporation shall be the minimum necessary to carry on an efficient and continuous operation. Dumping of long lines of aggregate on the roadbed and prolonged periods of hauling adjacent thereto will not be permitted. Unless prevented by unavoidable conditions, aggregate shall be incorporated, mixed, shaped, compacted, and finished not later than the second day following delivery to the roadbed.

310.03.6--Mixing.

310.03.6.1--General. During the mixing operations, clay balls and other undesirable materials present in sufficient quantity to impair the quality of the course shall be removed.

310.03.6.2--Road Mix Method. After the stabilizer aggregate has been uniformly spread, the material shall be scarified, if necessary, and the mixing operation begun immediately.

All preliminary scarifying and mixing shall be carefully controlled to provide an undisturbed foundation course with the designated grade and cross section.

The Contractor shall be responsible for damage to or contamination with the underlying material or shoulder material, and shall make corrections and repairs as necessary at no additional cost to the State.

All material to be stabilized shall be thoroughly mixed and pulverized by incorporating the added materials so that the course will be homogeneous throughout. During the mixing operation, water shall be applied as necessary to provide the needed moisture content for obtaining the required density.

Particular care shall be exercised to insure satisfactory moisture distribution along the edges of the course, and to avoid the application of excess water on any portion of a section.

310.03.6.3--Central Plant Method. Water shall be added during the mixing operation in the quantity necessary to provide the needed moisture content. Mixing shall continue until a homogeneous mixture is obtained. After the mixing is complete, the mixture shall be transported while at the proper moisture content for compaction, and shall be placed on the prepared grade by means of an aggregate spreader.

The Contractor shall deliver to the roadbed a sufficient quantity of mixed material to produce the designated course. All material placed in excess of the tolerances allowable in Section 321 shall be removed and hauled from the project without compensation, or removed and placed at other approved locations requiring use of the same material.

310.03.7--Spreading, Compacting, and Finishing. The mixed material shall be spread immediately after mixing, or after delivery in the case of central plant mixed material.

Spreading shall be carried out in a manner that will minimize segregation and will result in a completed course within the tolerances allowable.

Compaction shall start longitudinally at the outer edges of the course and proceed toward the center. The material shall be sprinkled or aerated as necessary during compaction to maintain the needed moisture content.

Shaping and compaction shall be carried out in such a manner as to prevent lamination and shall continue until the entire depth and width of the course has obtained the required density. Throughout the entire compaction operation, the shape of the course shall be maintained by blading and rolling. Surface compaction and finishing shall be performed so as to produce a smooth, closely knit surface, free from lamination, cracks, ridges, or loose material, and

conforming to the required section and the established lines and grades within the tolerances allowable.

Prior to subsequent construction, all irregularities, depressions, soft spots, and other deficiencies shall be corrected to meet the requirements of these specifications at no additional cost to the State.

After compaction and finishing, if the mixture contains plus No. 4 aggregate and the course is to serve as a base for bituminous pavement, at least one complete coverage shall be made with a steel wheel roller. The Engineer may waive this requirement for shell stabilized bases.

In addition to the requirements for density and correction of irregularities, depressions, or soft spots, the Contractor shall be fully responsible for constructing and maintaining a course which will remain firm and stable under all construction equipment and other traffic to which the course is subjected prior to the acceptance of the work.

Density tests will be performed in accordance with the methods as provided in Subsections 700.03 and 700.04.

Determination of acceptance of compaction of mechanically stabilized courses for required density will be performed on a lot to lot basis. Each lot will be each 2,500 linear feet per layer placed. At the discretion of the Engineer, a residual portion of a lot completed during a day's operation may be considered a separate lot or may be included in the previous or the subsequent lot, except that any day's operation of less than one full lot will be considered a lot.

The lot will be divided into five approximately equal sublots with one density test taken at random in each subplot. The individual tests and the average of the five tests shall equal or exceed the values as shown in the table below. For any course which is to be subsequently chemically treated, the average of the five density tests shall equal or exceed 93.0 percent with no single density test below 89.0 percent.

Composite Mixture		
Type	Lot Average	Individual Test
A	102.0	98.0
B	100.0	96.0
C	99.0	95.0
D	97.0	93.0

The finished surface of all courses shall conform to the required section and the established lines and grades, within the tolerances allowable under Section 321. All finished courses shall be continually maintained until covered by a subsequent course or the work released from maintenance.

310.04--Method of Measurement. Mixing, shaping, and compaction will be measured by the square yard, station, or mile, as designated, for each course included in the contract.

Stabilizer aggregate will be measured by the cubic yard (LVM) or by the ton, as designated in the bid schedule of the contract. Other materials (except water) specified and incorporated into accepted work will be measured and paid for under the provisions of the governing pay items shown in the contract. When the method of measurement is by the ton, measurement will be made on the dry unit weight basis at the point of weighing. The moisture determination for computing the dry unit weight will be made in accordance with the methods set out in Subsection 700.03 at least one time each day, and as many additional times as the Engineer deems necessary. Water will not be measured for payment.

Unauthorized wastage or usage of materials, unused materials remaining in stockpiles, and additional materials required for correction of unacceptable work will be deducted from measured quantities. Determination of quantities to be deducted will be made by the method the Engineer considers to be most practicable and equitable, and the Engineer's decision as to the method used for such computations shall be final.

310.05--Basis of Payment. Mixing, shaping, and compaction will be paid for at the contract unit price per specified unit. Stabilizer aggregates will be paid for at the contract unit price per specified unit. The prices thus paid shall be full compensation for completing the work.

Payment will be made under:

310-A: Mixing, Shaping, and Compaction, Type____, Group____	- per square yard, station, or mile
310-B: Size____ Stabilizer Aggregate, Coarse	- per cubic yard or ton
310-C: Stabilizer Aggregate, Shell	- per cubic yard or ton
310-D: Stabilizer Aggregate, Medium	- per cubic yard or ton
310-E: Stabilizer Aggregate, Fine	- per cubic yard or ton

SECTION 311 - LIME-FLY ASH TREATED COURSES

311.01--Description. This work consists of constructing one or more courses of a mixture of soil, soil aggregate or aggregate, fly ash, lime, and water in accordance with these specifications and in reasonably close conformity with the

lines, grades, thickness and typical cross sections shown on the plans or established by the Engineer.

Unless otherwise provided, the Contractor may use either the travel plant or central plant method.

311.02--Materials. Soil, soil aggregate or aggregate, when Contractor furnished, shall conform to the requirements set forth on the plans or in the contract. Other materials shall conform to the requirements of Division 700 as specified in the following subsections:

Cut-back Asphalt	702.06
Emulsified Asphalt	702.07
Aggregate	703.20
Water	714.01
Lime	714.03
Fly Ash	714.05

311.02.1--Soil-Lime-Fly Ash Design. Quantities and percentages of lime and fly ash shown on the plans are preliminary. The actual application rate will be established from tests made prior to beginning treatment. The design of soil-lime-fly ash courses shall be performed by the Central Laboratory. At least 45 days prior to the proposed use of a lime-fly ash course, the Contractor shall make available materials conforming to the specifications and proposed for use in the mixture for sampling and testing by the Department as the Engineer may consider necessary for the establishment of a mix design.

The approved proportions of material will govern during the progress of the work, and changes in source or character of any material shall not be made without approval. Approval will be based on verification of a mix design.

311.02.2--Curing Seals. Curing seal shall be Emulsified Asphalt, Grade EA-1, SS-1, CMS-2h, or MS-2h meeting the applicable requirements of Section 702.

311.03--Construction Requirements.

311.03.1--General. Fly ash shall be spread at the specified rate and lightly disked or mixed into the soil or soil aggregate prior to spreading the lime.

Prior to the application of fly ash, a light windrow shall be bladed along the edges of the area to be treated, or the surface on which the fly ash is to be applied shall be scarified to retain the spread fly ash. The depth of scarification shall be carefully controlled so that the surface of the roadbed below the scarified material will remain undisturbed and conform to the established cross section.

311.03.2--Equipment. Equipment necessary for the proper prosecution of the

work shall meet the applicable requirements of Subsection 308.03.2.

311.03.3--Preparation of Grade. Before treatment, the roadbed shall be prepared in accordance with the requirements of Section 321.

311.03.4--Application.

311.03.4.1--Fly Ash. Fly ash shall be applied as set out in Subsection 308.03.7, except that weather limitations shall be in accordance with Subsection 311.03.5.

311.03.4.2--Lime. The rate of application of lime shall be as specified.

Application of lime shall be accomplished by either an approved "dry application" or "slurry application" method.

The following guide lines will govern the acceptability of the method to be used:

Dry Application. Hydrated lime applied by this method shall be spread uniformly and shall be sprinkled with sufficient water to prevent loss of lime by wind. Spreading of hydrated lime when wind and weather conditions are unfavorable will not be permitted nor will spreading of lime by motor patrol be acceptable. The use of quick lime in the "dry application" method will not be permitted.

Slurry Application. Lime applied by this method shall be mixed with water in approved agitation equipment and applied to the roadbed as a thin water suspension or slurry. The distributing equipment shall be equipped to provide continuous agitation of the slurry until applied on the roadbed. The proportion of lime shall be such that the "Dry Solids Content" shall be at least 30 percent by weight.

The distribution of lime at the rate specified shall be attained by one or more passes over a measured section until the specified percentage of lime has been spread. After each successive pass the material shall be incorporated into the soil with the mixing equipment.

311.03.5--Weather Limitations. Lime-fly ash treatment shall not be performed when either the soil or soil aggregates or the surface on which a lime-fly ash treated material is to be laid is wet or frozen or when it is raining or snowing. Processing operations for the lime-fly ash course shall not begin until the surface temperature is at least 40°F and rising. Construction of the soil/soil aggregate-lime-fly ash stabilized course will not be permitted between November 30 and March 1.

311.03.6--Fly Ash-Lime and Water Mixing Phase. The lime and water shall be incorporated uniformly into the soil course of fly ash and aggregate. The

mixing and water application shall be continued until a homogeneous mixture of which 100 percent of the material by dry weight, exclusive of gravel and stone, will pass a two-inch sieve and 60 percent will pass a No. 4 sieve. At the completion of moist mixing and during the compaction operations, the percentage of moisture shall be that necessary to obtain the required density. No mellowing period will be required or permitted, and compaction shall begin immediately. The mixing, water application, and final compaction shall be completed during the same work day.

311.03.7--Shaping, Compacting, and Finishing. The shaping, compacting, and finishing shall be in accordance with the provisions and requirements of Subsection 308.03.9, except that, for the purpose of determining reasonable conformance with the designated thickness of the treated course, it shall be understood that the depth of the treated course shall not vary from designated thickness by more than minus one-half (1/2) inch or plus one (1) inch.

311.03.8--Protection and Curing. Each completed course shall be covered with a bituminous curing seal as soon as possible but no later than 24 hours after completion. The surface shall be sealed with one of the specified bituminous materials applied by a pressure distributor at the rate of 0.10 to 0.25 gallon per square yard or as directed by the Engineer. The bituminous material shall be heated or otherwise prepared to insure uniform distribution. Should the Contractor fail to seal the lime-fly ash course within the time specified, the Engineer will suspend all other work and withhold payment of the current estimate(s) until all damages resulting therefrom is corrected and the lime-fly ash course is sealed.

A subsequent course shall not be placed on the sealed lime-fly ash course for at least seven (7) calendar days. During this 7-day period, the lime-fly ash course shall not be subjected to any type of traffic and equipment.

The Contractor shall maintain the lime-fly ash course and the curing seal in a satisfactory condition until covered by a subsequent course. Protection shall include immediate repairs of any surface irregularities or other defects that may occur or develop. It shall be the Contractor's responsibility to control traffic and equipment loads to avoid damage and to guard against freezing of the lime-fly ash treated material.

All damage resulting from the Contractor's failure to protect and cure the lime-fly ash course as specified herein or from freezing that may occur prior to being covered with the next course shall be corrected at no additional cost to the State.

The Contractor shall submit, for approval of the Engineer, a method of correction that will restore the strength of the damaged material to that originally specified.

311.04--Method of Measurement. Lime and fly ash will be measured by the

ton in accordance with Section 109. If bagged lime is used, the net weight as packaged by the manufacturer will be used for measurement.

The basis of pay for jobsite slaked lime slurry shall be the "calculated method" as provided for jobsite slaked lime slurry in Subsection 307.04.

Aggregate will be measured by the ton or cubic yard (LVM). When measurement is by weight, the weight of moisture, surface and hygroscopic, will be deducted.

Processing will be measured by the square yard and shall include preparation of the roadbed, scarifying, pulverizing, drying of the material, mixing of the various materials, compaction of the mixture, finishing, protection and curing, and maintenance of the completed course.

Water and curing seal will not be measured for separate payment.

311.05--Basis of Payment. The accepted quantities of lime and fly ash treated material will be paid for at the contract price per ton for lime and fly ash, per ton or cubic yard (LVM) for aggregate, and per square yard for processing lime and fly ash treated material complete in place. The prices thus paid shall be full compensation for completing the work.

Payment will be made under:

- 311-A: ____” Processing Lime and Fly Ash Treated Course - per square yard
- 311-B: Lime - per ton
- 311-C: Fly Ash, Class____ - per ton
- 311-D: Aggregate - per cubic yard or ton

SECTION 320 - SHOULDERS

320.01--Description. This work consists of constructing the shoulder portion of courses specified to be constructed; the shaping, compacting, finishing, and surfacing, if required, of the shoulder portion of the work in reasonably close conformity with the required lines, grades, and cross sections; and the construction and establishment of erosion control items specified for the shoulder portion of the work. All work shall conform to the sequence and timing indicated herein and to the other applicable requirements of the contract.

This work shall also include preservation from injury or damage to and repair and reconstruction of, if necessary, underlying courses and other elements of the

pavement structure. Except as otherwise specified, construction of shoulders shall also include reshaping, finishing, and mowing of cut ditches, foreslopes, and upper embankment slopes adjacent to shoulders. Areas to receive this work shall include the areas between the finished shoulder line and the same elevation at the back of the ditch in cut sections and the areas on fill slopes between the finished shoulder line and a line 12 feet horizontally outside the finished shoulder line. Similar areas in the median portion of divided highways shall also be reshaped and finished.

320.02--Materials. Materials used in constructing shoulders shall meet the applicable requirements of Division 700.

320.03--Construction Requirements.

320.03.1--Preparation of Grade. Before beginning each course of shoulder construction, the foundation shall be prepared in accordance with Section 321.

320.03.2--Construction Details. Except as otherwise specified, the construction of each course of the shoulders shall be in accordance with controlling requirements for bases constructed of like material.

Shoulder construction shall begin at the earliest practicable time and proceed in the proper sequence with contiguous base or pavement construction. Each designated course for shoulders shall be constructed to the established lines, grades, and cross sections within tolerances allowable under Section 321 and shall be firm and stable; reference is made to Subsection 321.03.

Determination of acceptance of compaction of shoulders for required density will be performed on a lot to lot basis. Each lot will consist of each day's operation per layer placed, with a maximum lot length of 10,000 linear feet.

The lot will be divided into five approximately equal sublots with one density test taken at random in each sublot. The lot average and each single density test shall conform to the required density.

The required density for the shoulder portion of any layer or course shall be the same as for the adjacent (internal) portion of the layer or course when constructed of the same material.

The required density for the shoulder portion of any layer or course where the adjacent (internal) portion is of unlike material shall be as follows:

Granular Material	Lot	Individual
<u>Class</u>	<u>Average</u>	<u>Test</u>
10	94.0	90.0
7,8 or 9	95.0	91.0
5 or 6	96.0	92.0
3 or 4	97.0	93.0
1 or 2	98.0	94.0

except,

- (a) When the finished shoulder is required to be paved, the required density for such shoulder course shall be that required for the same material for bases, and
- (b) Where an existing pavement is to be overlaid, or widened and overlaid, without shoulder widening, and the existing shoulder is to be raised to match the new pavement, satisfactory density of each layer of new shoulder material shall be that which can be obtained from six coverages of a pneumatic roller with an operating weight of approximately six tons while the shoulder material is at the proper moisture content.

In cases of base or pavement in which portland cement is used as a material of construction, shoulder construction shall follow immediately upon expiration of the curing period, unless it has been otherwise provided that the shoulder course be constructed in advance of the contiguous course.

The rate of progress for each phase of shoulder construction shall be consistent with the rate of progress of the controlling construction. When the Engineer deems that other operations are being carried on to the unnecessary neglect of shoulder construction, the Engineer may suspend the operations in progress and order that shoulder construction be brought up to and then continued, without prejudice to other work, in the proper sequence.

320.04--Blank.

320.05--Basis of Payment. Unless otherwise specified in the contract, no separate payment will be made for shoulder construction. Payment will be made for the materials and their processing when set up in the contract as pay items. All additional work involved in shoulder construction is considered an obligation of the Contractor subsidiary to the placement of the materials required and work performed for which provisions for payment are contained in the contract.

SECTION 321 - IN-GRADE PREPARATION

321.01--Description. The term "in-grade" is defined as existing material in place

regardless of whether the material was placed under this contract or a previous contract. The term "in-grade preparation" is defined as the work required to prepare, blade, shape, scarify, disk, mix, compact, etc. the existing material to specification requirements prior to placement of a subsequent course of material.

Figure 1, Section 101, graphically defines the limits of the roadway, the design soil and the components of the pavement structure.

In-grade preparation shall be in reasonable close conformity with the lines, grades, and typical section(s) shown on the plans. All work will be performed in the sequence and timing specified.

Except as specifically provided herein, no direct compensation will be allowed for in-grade preparation.

321.01.1--Applicability. In-grade preparation will be required on all projects which require replacement of any component of a pavement structure or chemical treatment of the design soil.

In-grade preparation will not be required on pavements or chemically treated courses which are to remain in place undisturbed.

Unless otherwise specified, the in-grade preparation course shall be the top six inches of the design soil.

321.02--Blank.

321.03--Construction Requirements.

321.03.1--General. Prior to beginning in-grade preparation, the roadway will be cleaned of all vegetation or debris, bladed, shaped and filled as necessary to obtain the required line, grades and typical section as shown on the plans or as specified. The Contractor will perform unclassified excavation where required for grade changes, removal of temporary ramps at bridge ends, shape foreslopes and cut ditches to the required line, grade and typical section, and other work required to alter work performed on previous contracts. All material obtained in preparation prior to in-grade preparation work will be disposed of or utilized by the Contractor.

321.03.2--First In-Grade Course.

321.03.2.1--Design Soil. When the first in-grade preparation course is the top portion of the design soil, which was constructed under a previous contract, the top six inches, unless a greater depth is specified, shall be broken up, either by scarifying or blading to the specified depth and then thoroughly mixed by a disk-harrow. If the embankment design soil was constructed under this contract in

accordance with the requirements of Section 203, then only the cut section will require mixing as stated herein. The disk shall be of sufficient weight and size to cut a minimum depth of eight inches, or ten inches when eight inches design soil mixing is required, in loose material. After mixing with a disk-harrow, the roadway will be shaped and compacted to the proper section and density.

321.03.2.2--Component of Pavement Structure. When the first in-grade preparation course is a component of the pavement structure, other than design soil, the course shall be prepared by blading, shaping to the specified section, and compacting to the specified density for the particular layer being prepared.

321.03.3--Unsuitable Materials. All materials which cannot be stabilized and compacted to the required density, shall be removed and disposed of as directed. The material removed will be replaced by acceptable materials. Unless the unsuitable material was placed under this contract, the removal, disposal, and replacement of the material will be measured and paid for under the appropriate items of the contract. Materials, which meet contract requirements, except for moisture content will not be classified as unsuitable materials.

321.03.4--Stability. When density and stability cannot be obtained due to the instability of the underlying material, the Contractor will take the necessary action to stabilize and compact the underlying material. Unless the unstable material was placed under this contract, the work required to stabilize and compact the material will be paid for under the appropriate items of the contract. When the Contractor has initiated appropriate action to stabilize and compact the underlying material and density cannot be obtained, then the material will be classified as unsuitable and proceed in accordance with Section 321.03.3.

321.03.5--Haul, Protection and Repair. All materials hauled through or over any part of the project shall be hauled in the sequence and manner to cause the least damage to the previously placed course. The Contractor's operations shall provide the maximum protection to each course in place from deformation or contamination from underlying material.

The first course of material to be placed on a chemically treated design soil shall be placed by hauling to the point nearest the source of the material, thus hauling over the material being placed. Subsequent hauling shall be over the maximum practical thickness of material in order to provide the greatest protection to the underlying material.

The Contractor shall satisfactorily maintain the material over which he is hauling, and the materials being hauled shall be spread as hauling progresses to prevent hauling equipment from repetitive passes alongside lines of dumped and unspread material.

The Contractor shall repair, at no additional cost to the State, all damage to

prepared in-grade material whether the material was placed under this contract or under previous contract.

321.03.6--Density. The required density for in-grade preparation of courses which do not require a chemical treatment or modification shall be the required density for the particular course. The required density for courses which require chemical treatment or modification shall be 93.0 percent prior to the addition of the chemical, stabilizer or modification.

321.03.7--Tolerances.

321.03.7.1--General. It shall be understood that although certain tolerances in grade, cross section, and density are allowable under the specifications, it shall be the Contractor's responsibility to prepare the surface of all in-grade courses to the degree of true grade and cross section and to the density and stability necessary to insure the ability to construct subsequent courses to the specified requirements for surface, thickness, and compaction. It is essential in pavement structure construction that the degree of accuracy must be increased for each succeeding course in order that the final surface requirements can be met and the thickness of each course will be within design tolerances. It shall be the Contractor's responsibility to construct each course to the degree of accuracy, maximum allowable tolerances notwithstanding, necessary to insure meeting final requirements.

321.03.7.2--Vertical Tolerances. No vertical tolerances will be allowed which will pond water. Otherwise, allowable tolerances will be as follows:

321.03.7.2.1-For Design Soil.

Tolerances from Design Grade:

- a. Where the top portion of the design soil is to be lime treated or lime-fly ash treated and the next course is stone or is to be chemically treated -
 - Before Treatment -1" (1)
 - Treatment In Place ±1" (2)

- b. Where the top portion of the design soil is to be cement treated and the next course is stone or is to be chemically treated -
 - Before Treatment -1"
 - Treatment In Place -1"

- c. Where the design soil is not to be treated and the next course is stone or is to be treated or untreated -
 - Preparation In Place -1"

- d. Where the design soil is not to be treated and a superimposed course is not required under this contract -

- In Place ±1"

Notes: (1) From the design grade established before spreading lime to allow for bulking.
(2) From the design grade established for bulked material.

321.03.7.2.2--For Bases.

The surface tolerances from design grade before placing base material shall be the tolerances from design grade in place as set out herein for design soils.

Grade stakes or other reference points shall be set at 25-foot intervals; when tested longitudinally, the maximum deviation when measured at the midpoint (12 1/2 feet) shall be ±1/2 inches.

- a. Where a base course is not to be treated and the next course is to be bituminous pavement -

- In Place ±1/2"

- b. Where a base course is stone or is to be cement treated and the next course is a drainage layer -

- In Place ±1/2"

- c. Where a base course is to be lime-fly ash treated and the next course is a drainage layer -

- In Place ±1/2" (3)

- d. Where a base course is stone or is to be cement treated and the next course is to be bituminous pavement -

- In Place ±1/2"

- e. Where a base course is to be lime-fly ash treated and the next course is to be bituminous pavement -

- In Place ±1/2" (3)

Note: (3) From the design grade established for bulked material.

Where stone is specified, it shall meet the requirements of Section 304.

321.03.7.2.3-For Drainage Layers.

Tolerances from Design Grade:

Where a drainage layer is required - - In Place +1/8" to -3/8"

321.03.7.2.4--For Any Course.

Tolerances from Design Grade:

- a. Where a course is to be stone or is to be treated or untreated and the next course is a drainage layer or bituminous pavement -

- In Place $\pm 1/2"$

- b. Where a course is stone or is to be treated, followed by a drainage layer and portland cement concrete pavement -
 - Under the Form Line or Track Line $\pm 1/8"$ (4)
 - Elsewhere -1" (5)

Notes: (4) The Contractor may construct the course at the form line to a tentative grade having a tolerance of not more than minus 1/2 inch, in which case the Contractor shall, at no additional cost to the State, bring the surface of the base at the form line to the specified grade and density with materials and methods approved by the Engineer and consistent with the requirements for foundation formation for forms or tracks required under the contract.

- (5) Provided the Contractor places at no additional cost to the State, at the time of placing portland cement concrete base course or pavement, the additional concrete necessary to compensate for the deficiency from a true design base grade.

321.03.7.2.5--For Mechanical Stabilization and In-Grade Modification.

Where material is to be mechanically stabilized or modified with stabilizer aggregate or other materials on the roadbed, the tolerance from design grade, both before spreading the aggregate and after mechanical stabilization, shall be those as respectively set out hereinbefore with an appropriate allowance having been made in the grade prior to spreading the aggregate to compensate for anticipated bulking.

321.03.7.2.6--Thickness. Unless otherwise specified and except for chemical treatment, mechanical stabilization, in-grade modification, and in-grade preparation of the top portion of the design soil, no thickness determination as such will be required for bases. The preceding tolerances from design grade shall determine the tolerance limits for thickness.

The thickness tolerance for in-grade preparation of the top portion of design soil shall be plus or minus one inch. For chemical treatment, mechanical stabilization, or in-grade modification, thickness tolerances shall be those set out in the sections applicable to the required courses.

321.03.7.3--Horizontal Tolerances. Allowable horizontal tolerances for in-grade preparation shall be those set out in the respective sections for the required courses. Where no horizontal tolerance is specified, the tolerance for a course shall be that which will not result in an unsightly appearance or detract from the esthetic value of the finished crown line and slope.

Each course of base and shoulder materials, and combined courses of shoulder materials and the top portion of the design soil shall be shaped in such a manner that after compaction the finished course and combined courses shall closely conform to the widths, lines grades, and cross sections shown on the plans or established.

321.04--Method of Measurement. Unless shown as a separate pay item in the proposal, in-grade preparation will not be measured for direct payment, but shall be considered a necessary part of the construction involved, and the cost thereof shall be included in the appropriate contract unit prices.

When shown as a separate pay item, in-grade preparation of the depth specified will be measured by the mile for each separate roadway of the main facility without respect to width or number of lanes or courses involved. No separate measurement for payment will be made for frontage roads, interchanges, intersections, entrances, or other features of the work, nor for intersecting roads unless such roads are set out under the contract as separate projects. It shall be understood that the cost of in-grade preparation for such subsidiary facilities is included in the contract unit price per mile for the main facility.

In the case of in-grade preparation of material in place under previous contract, if it is necessary to excavate, pickup, load, and haul any of the in-grade material for use at other locations or for disposal as directed in order to prepare the section in accordance with the design grade, typical sections and conditions specified, such work shall be performed and will be measured and paid for under the applicable provisions and requirements as follows:

- a. When designated in the contract, under the provisions and requirements designated.
- b. When material loaded and hauled is used in lieu of material required under another item, measurement and payment will be made under the item of use.
- c. Measurement and payment for base or pavement material required in the work performed will be made in accordance with the requirements and provisions for use of such material.
- d. When an item of excavation is not included in the contract, excavation required by the Engineer to be picked up, loaded, and hauled to other

locations will be paid for as Extra Work or at unit prices established by supplemental agreement.

- e. Necessary haul of material not specified to be furnished by the Contractor, or not designated as absorbed haul (AH), shall be performed and will be paid for as provided under Section 205, or, in the event the contract does not provide a unit bid price for haul, as Extra Work.

321.05--Basis of Payment. Except as provided above, no payment will be made for in-grade preparation. It shall be fully understood that compensation: for all specified scarifying, disk-harrowing, mixing, or other processing; for furnishing and applying all water; for all aerating necessary to dry wet materials; for all shaping and compacting; for all other work of whatever nature necessary for preparation as set forth under this section; and for furnishing all labor, tools, equipment and incidentals necessary to complete the work shall be included in the unit prices for the materials used and the work performed under contract items.

When shown as a separate pay item in the contract, in-grade preparation will be paid for at the contract unit price per mile, which price shall be full compensation for satisfactorily completing the work.

Payment will be made under:

321-A: ____" In-Grade Preparation - per mile